PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 14 MAY 2004
WIPO PCT

Applicant's or agent's file reference WO 21.1018	**FOR FURTHER ACTION** See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP 02/14822	International filing date *(day/month/year)* 20.12.2002	Priority date *(day/month/year)* 11.01.2002
International Patent Classification (IPC) or both national classification and IPC G01N27/22		
Applicant SERVICES PETROLIERS SCHLUMBERGER		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
16.07.2003	14.05.2004
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Joyce, D Telephone No. +31 70 340-3093

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP 02/14822

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-6 as originally filed

Claims, Numbers

1-10 received on 30.04.2004 with letter of 27.04.2004

Drawings, Sheets

1/1 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-10
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-10
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-10
	No:	Claims	

2. Citations and explanations

   see separate sheet

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents cited from the International Search Report:

D1: EP-A-0 308 004 (SCHLUMBERGER PROSPECTION ;SCHLUMBERGER LTD (NL)) 22 March 1989 (1989-03-22)

D2: PATENT ABSTRACTS OF JAPAN vol. 1999, no. 08, 30 June 1999 (1999-06-30) & JP 11 064067 A (SEKIYU KODAN;NKK CORP; SEKIYU SHIGEN KAIHATSU KK; TEIKOKU SEKIYU KK; Y), 5 March 1999 (1999-03-05)

D3: WO 00 45133 A (ASPELUND AUDUN ;WIDEROEE TOR (US)) 3 August 2000 (2000-08-03)

D4: EP-A-0 510 774 (SHELL INT RESEARCH) 28 October 1992 (1992-10-28)

D5: FR-A-2 780 499 (SCHLUMBERGER SERVICES PETROL) 31 December 1999 (1999-12-31) cited in the application

D6: WO 01 71327 A (SCHLUMBERGER CA LTD ;SALAMITOU PHILIPPE (FR); SCHLUMBERGER SERVICE) 27 September 2001 (2001-09-27) cited in the application

Claim 1 of the present application relates an apparatus for integrating in a tubing in an oil well, electrodes used for characterising the flow of a multiphase fluid in the tubing. Document D1 which is considered to represent the closest prior art, discloses a device for integrating electrodes for characterising the flow of a multiphase fluid into a tubing through which the fluid flows comprising a tube section made from an electrically insulating material (cf., D1 Page 5 line 9) having an internal diameter substantially equal to that of the tubing said tube section being integrated into the tubing and bearing the electrodes on its external surface (cf., D1 Fig 1 and Page 3 lines 14-18).

Vis-a-vis this known device the apparatus of sole independent claim 1 differs in that the tube section is encircled in a flexible compensation sheath in which the shath delimits with the tube section a first closed annular space (22)which filled ith an insulating and incompressible fluid, and with a portion of the tubing (10) encircling the sheath, a second annular space (18) which communicates with the fluid flowing in the tubing. The apparatus of claim 1 is thus novel and satisfies the criterion of Article 33(2) PCT.

This additional feature addresses the problem of protecting the electrodes while conducting down-hole measurements.

In particular, as is evident from the applicants description (cf., Page 1 line 29-Page 2 line 5), the particular arrangement as is claimed in sole independent apparatus claim 1 provides a layout in which the tube section bearing the electrodes may be protected from the pressure which prevails within the tubing, by maintaining the tube section in equipressure.For example the pressure inside the tubing may be larger than 1000 bar when the device is implemented at the bottom of a well.

Such an apparatus for down-hole monitoring using an electrode arrangment as claimed is not apparent from the cited &/or consulted prior art, and as such apparatus claim 1 is also seen to involve an inventive step and satisfies the criterion laid down in Article 33(3) PCT.

Claims 2-10 respectively define further refinements of the inventive idea underlying independent claim 1, and as such these claims also met the requirements of Article 33 PCT.

As the industrial applicability of the claimed subject-matter of claims 1-10 is immediately apparent, all the requirements of Article 33 PCT are thus met.

CLAIMS

1. A device for integrating electrodes (12) for characterizing the flow of a multiphase fluid into a tubing (10) through which the fluid flows, said electrodes born at the external surface of a tube section (14), integrated into the tubing (10) and having an internal diameter substantially equal to the that of the tubing (10), said tube section (14) being encircled into a flexible compensation sheath (16) characterized in that the sheath (16) delimits with the tube section (14) a first closed annular space (22) which filled with an insulating and incompressible fluid, and with a portion of the tubing (10) encircling the sheath, a second annular space (18) which communicates with the fluid flowing in the tubing (10).

2. A device as claimed in claim 1, wherein seal rings (29) are secured on the ends of the tube section (14) bearing the electrodes (12).

3. A device as claimed in claim 2, wherein the flexible compensation sheath (16) is an elastic membrane, the ends of which are directly or indirectly secured on the seal rings (29).

4. A device as claimed in claim 2 or 3, wherein the seal rings (29) are secured on the ends of the tube section (14) bearing the electrodes (12) by means of interference or shrink fit, brazing, molding, O-rings, or bonding.

5. A device as claimed in any of claims 2 to 4, wherein the tube section (14) bearing the electrodes (12) forms, with the compensation sheath and the seal rings (29), a sensor assembly (27) which is mounted within a junction area between two sections (10a, 10b) of the tubing (10).

6. A device as claimed in claim 6, wherein the sensor assembly (27) is flexibly mounted within the junction area with interposition of elastic mountings (28).

7. A device as claimed in claim 5 or 6, wherein the junction (30) between the two sections (10a, 10b) of the tubing is threaded or welded.

8. A device as claimed in any preceding claim, further comprising a mixing system (32) placed in the tubing (10) upstream from the tube section (14).

9. A device as claimed in claim 8, wherein the mixing system is a Venturi (32) with an internal diameter d such as $0.316<\beta<0.7751$, with $\beta=d/D$, D being the internal diameter of the tubing (10), and the distance

between the outlet end of the Venturi (32) and inlet end of the tube section (14) bearing the sensors (12) is between 1 and 10 times the internal diameter of the tube.

10. A device as claimed in any of the preceding claims, wherein the tube section (14) is made out of an electrically insulating plastic, rubber derivative, polymer or ceramic material.